HOUSTON/GALVESTON

2015 HURRICANE GUIDE

2015 HURRICANE WORKSHOP
READY 25th ANNIVERSARY OR NOT

Introduction

Index of Pages

Hurricanes and tropical storms can bring damaging winds, devastating storm surge, flooding rains and tornadoes to Texas as storms like Ike, Alicia, Carla, Allison and countless others have shown. The 1900 Galveston Hurricane remains the deadliest natural disaster on record for the United States with an estimated 8000 deaths. It is important that residents of Southeast Texas prepare every year on what they need to do should a hurricane or tropical storm impact in our area. This hurricane guide and numerous hurricane town meetings and workshops across the Houston/Galveston region are meant to help citizens get ready for the hurricane season. The Houston/Galveston Regional Hurricane Workshop is celebrating its 25th year and remains a great example of private/public partnership in working together to promote public safety and fits in with the goal of developing a Weather Ready Nation.

This year we recognize the 100 year anniversary of the 1915 Galveston hurricane, a powerful hurricane which tested the island's seawall which was built in response to the killer storm in 1900. We also remember the 10 year anniversary Hurricane Rita, a hurricane that impacted the area in a much different way. Rita was a category 5 storm over the Gulf of Mexico which appeared to be heading right for the Houston/Galveston area. With images of the aftermath of Katrina fresh in everyone's mind, a massive evacuation occurred ahead of Rita. Many motorists were stuck on roadways in gridlock for hours trying to get out of the path of the storm. In the end Rita turned to the right and the Houston region was spared a direct hit. The difficult evacuation is what most people remember from Rita.

Each year it is important to look back at past storms for lessons learned and to go over preparedness material as we develop our plans for the upcoming hurricane season. This guide is meant to assist you in developing such a plan for yourself, your family, school or business. Many cities and towns hold hurricane town meetings or workshops which go over important information for residents of those communities. This year the Houston/Galveston regional hurricane workshop celebrates its 25th year in helping get the residents of this area ready for hurricane season.

Sincerely,

Daniel Reilly
Warning Coordination Meteorologist
National Weather Service Houston/Galveston

About the Hurricane

Hurricane Katrina

A tropical cyclone is a weather system that forms over the warm tropical waters and is characterized by a closed counter-clockwise circulation. It typically has a cluster of thunderstorms around the center and bands of showers and thunderstorms spiraling out from the center. The tropical cyclone is called a tropical depression, tropical storm or hurricane depending on the strength of the winds in the storm. The strongest of these, the hurricanes, have maximum sustained winds 74 mph or greater and often have an eye, a rain free area in the center of the storm where the winds are very light. The greatest threat of a landfall for the Texas coast is during August and September although hurricanes have struck the Upper Texas coast during every month from June to October.

Definitions

TROPICAL DEPRESSION: A tropical cyclone with maximum sustained winds of 38 mph or less.

TROPICAL STORM: A tropical cyclone with maximum sustained winds between 39 and 73 mph

HURRICANE: An intense tropical cyclone with sustained winds of 74 mph or higher.

TROPICAL CYCLONE: An organized weather system with a closed circulation that forms over warm tropical waters. These systems rotate counter-clockwise in the Northern Hemisphere.

HURRICANE/TROPICAL STORM WATCH: Hurricane or Tropical Storm conditions are possible in the watch area within 48 hours

HURRICANE/TROPICAL STORM WARNING: Hurricane or Tropical Storm conditions are expected in the warning area within 36 hours.

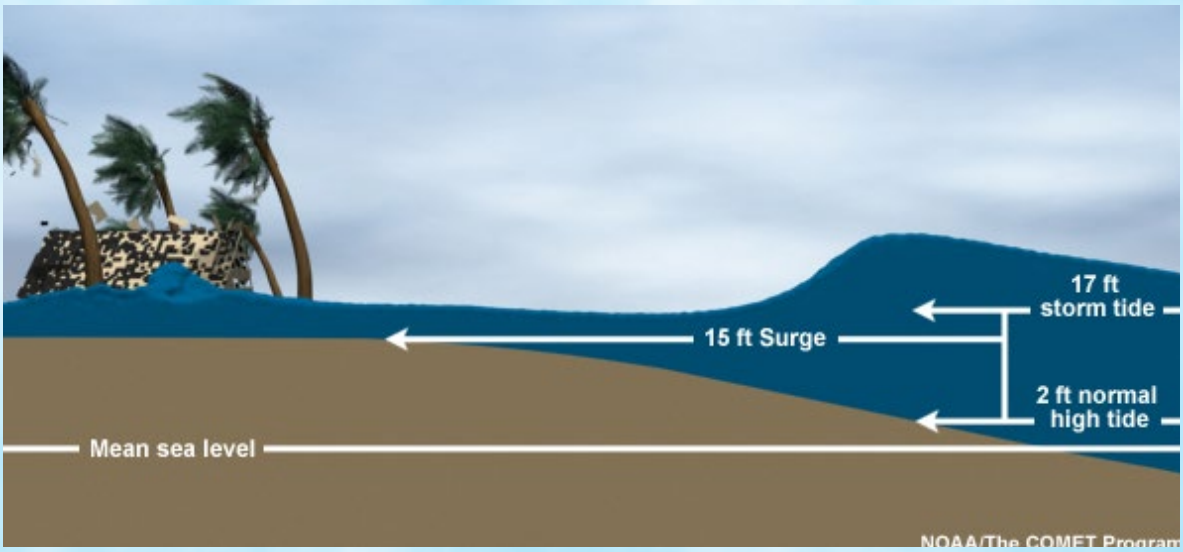
Saffir Simpson Hurricane Wind Scale

- Category 1 Winds 74 to 95 mph
- Category 2 Winds 96 to 110 mph
- Category 3 Winds 111 to 129 mph
- Category 4 Winds 130 to 156 mph
- Category 5 Winds greater than 156 mph

http://www.nhc.noaa.gov/aboutsshws.shtml

Storm Surge

Storm surge is the abnormal rise of water generated by a storm, over and above the predicted astronomical tides. Storm Tide is defined as the water level rise due to the combination of storm surge and the astronomical tide. The height of the waves adds on to the storm tide so an 8 foot wave crest on a 17 foot storm tide can lead to a water level height of 25 feet! The combination of storm surge floodwaters and battering waves can be very destructive as seen with many Texas Hurricanes like Ike (2008), Carla(1961), the 1900 Galveston Storm among others. The flood waters from storm surge can penetrate well inland in some cases depending on the elevation of the coastal plain. If the storm tide is greater than the land elevation (even if well inland) then storm surge flooding will be possible. In some cases Ike produced storm surge flooding greater than 20 miles inland.



Storm Surge Can be Deadly! Here are 8 Tips to be Ready

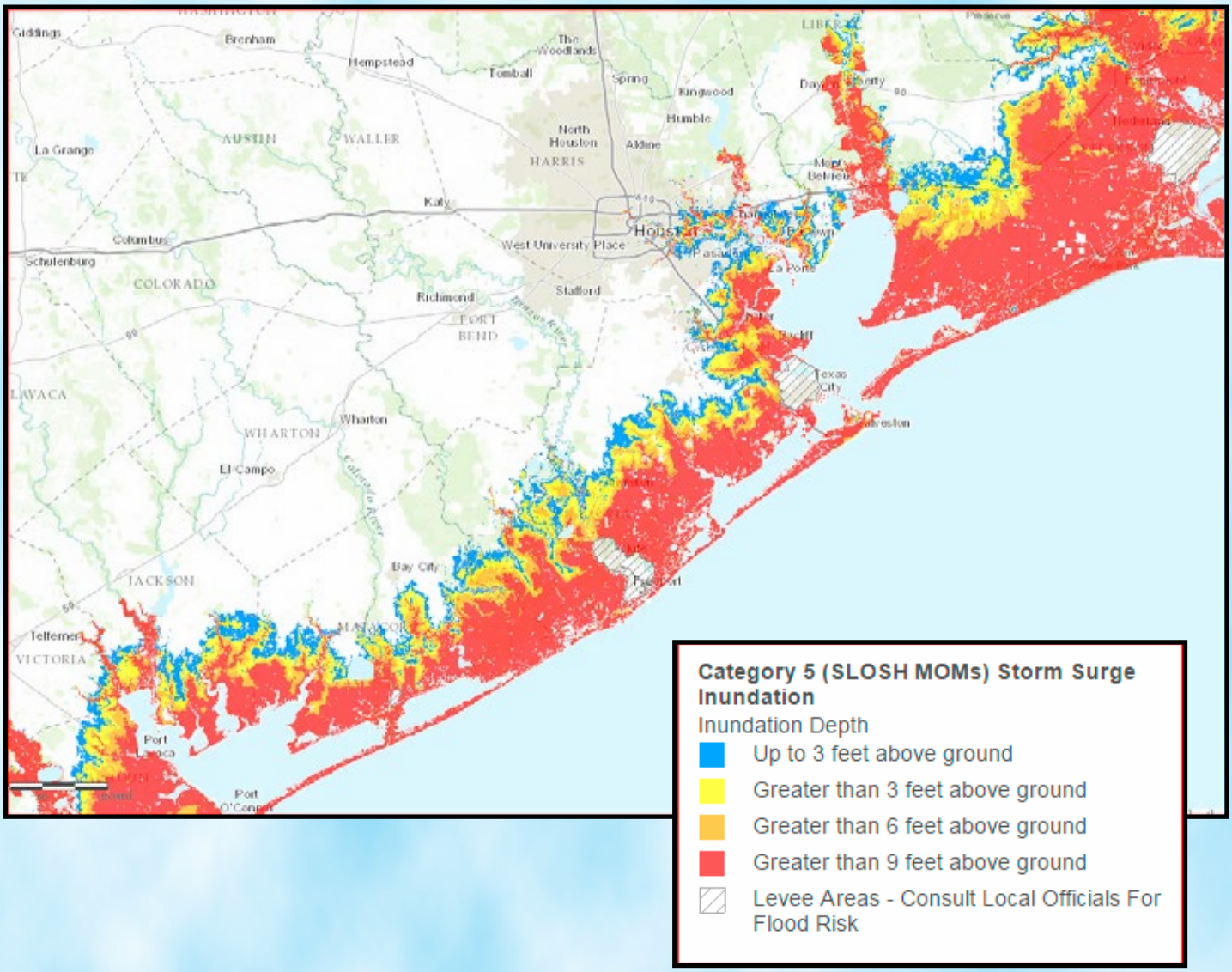
1. Storm surge flooding is often the greatest threat to life and property from a hurricane. It poses a significant threat for drowning. A mere six inches of fast-moving flood water can knock over an adult. It takes only two feet of rushing water to carry away most vehicles-including pickups and SUVs.
2. Storm surge can cause water levels to rise quickly and flood large areas, sometimes in just minutes. You could be left with no time to take action if you haven't already evacuated as instructed.
3. Storm surge depends on more than the category of the storm. These categories (Saffir-Simpson Hurricane Wind Scale) are based on winds and do not necessarily reflect the storm surge threat.
4. Tropical storms and hurricanes of any wind category (1-5) can cause life-threatening storm surge.
5. Many Gulf Coast areas are vulnerable to storm surge including areas many miles inland from the coastline. Find out today if you live in an evacuation zone (see pages 6 and 7 of this guide).
6. Storm surge can occur before, during and after the center of the storm passes through an area, and can sometimes cut-off evacuation routes. The water can rise well in advance of the coming storm, in some cases 36 hours or greater prior to landfall. Do not wait until the last minute to leave when an evacuation is ordered or you may become trapped.
7. During the peak of a storm surge event, it is unlikely that emergency responders will be able to reach you if you are in danger.
8. Your Mayor and/or County Judge could issue evacuation or other instructions for many reasons. Always follow the instructions of these local officials.

More info: www.hurricanes.gov or www.nhc.noaa.gov/surge

Storm Surge Flooding Map

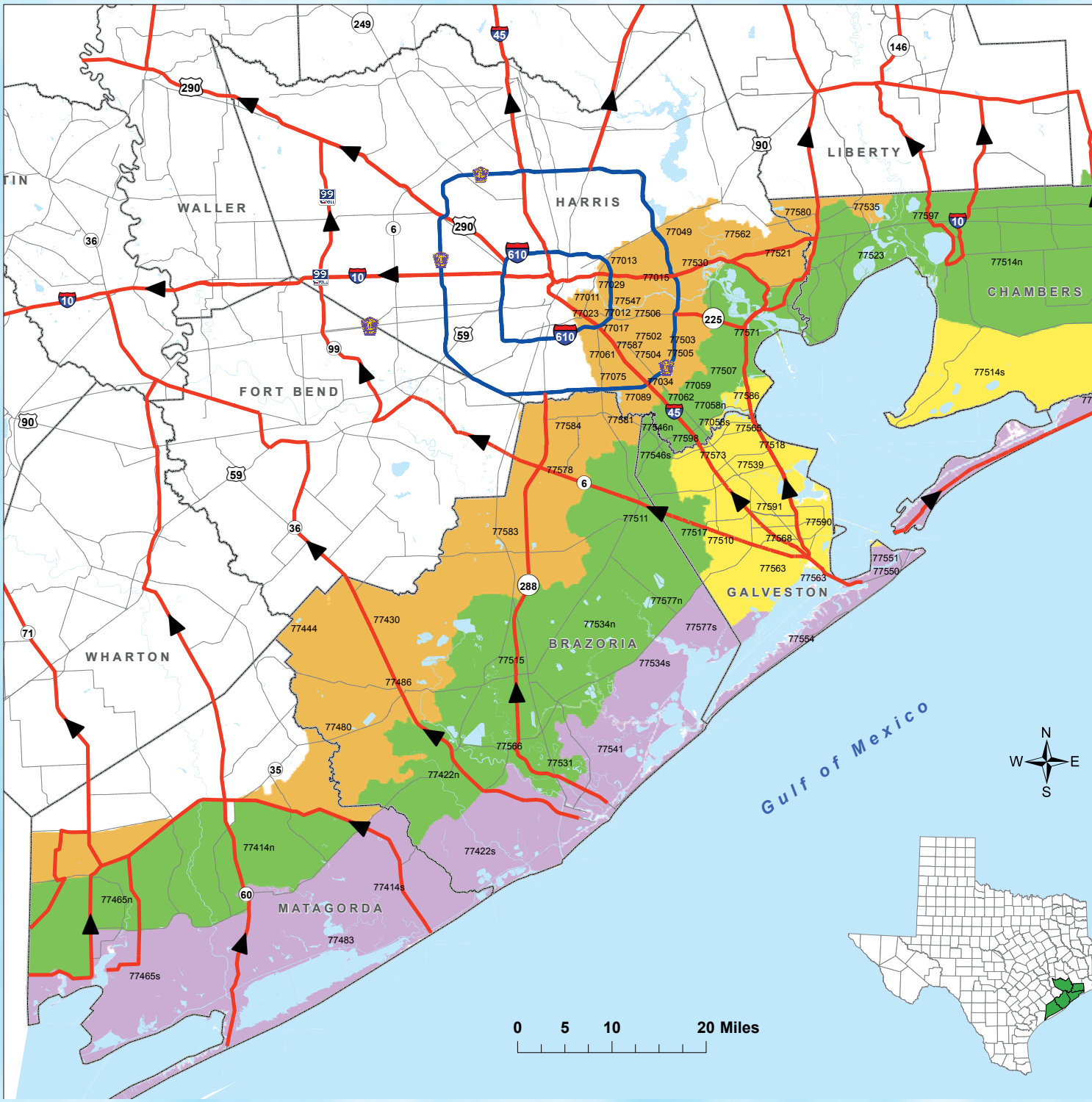
Storm Surge Flooding Map

The map below shows areas at risk of storm surge flooding from a very strong hurricane, a category 5 on the Saffir Simpson Hurricane Wind Scale (SSHWS). Although storm surge depends on more than the scale, this map does show what areas may be at risk for the strongest of hurricanes. Another important part of this map is noting the areas that are not shaded in. These are areas that are generally not susceptible to storm surge but may still be impacted by the other hazards of wind, flooding rains or tornadoes.



More info: www.hurricanes.gov **or** www.nhc.noaa.gov/surge

Zip Zone Evacuation



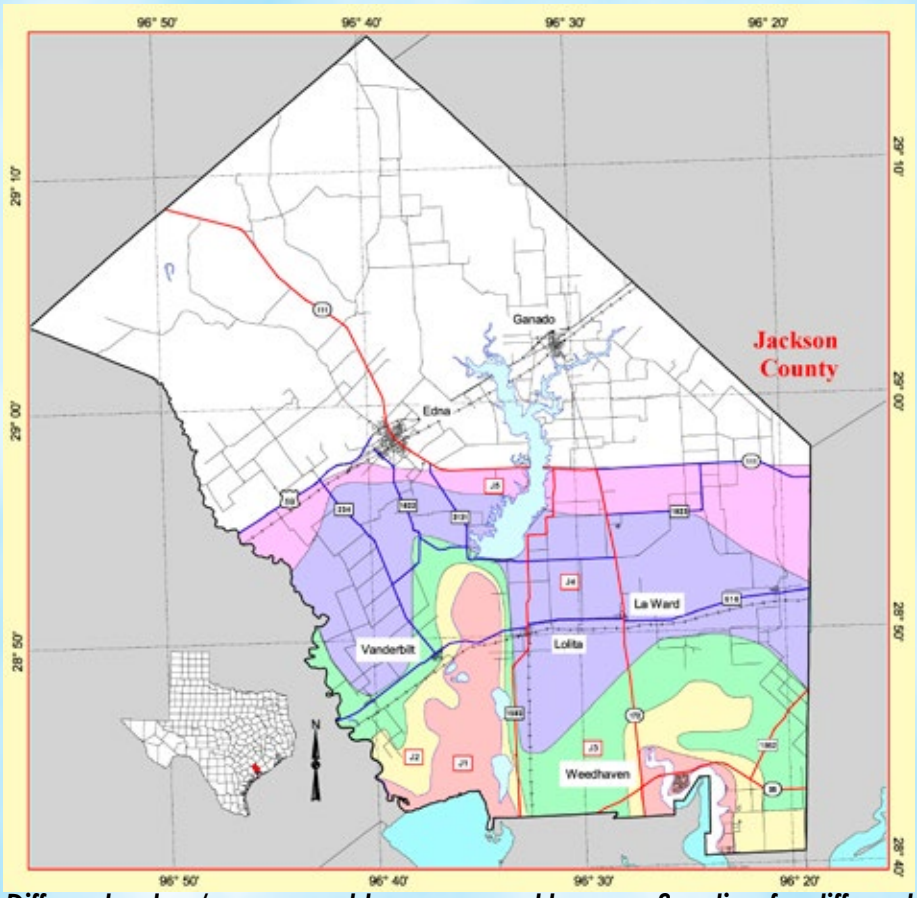
ZipZone evacuation zones roughly correspond to the following hurricane categories. However because surge depends on more than category, this is not always the case. Hurricane Ike was a category 2 but had a surge more like a typical 3 or a 4: Coastal-cat 1; Zone A-cat 1 or 2; Zone B-cat 3; Zone C-cat 4,5.

Brazoria, Chambers, Galveston, Harris and Matagorda Hurricane Evacuation Zip-Zones Coastal, A, B, C

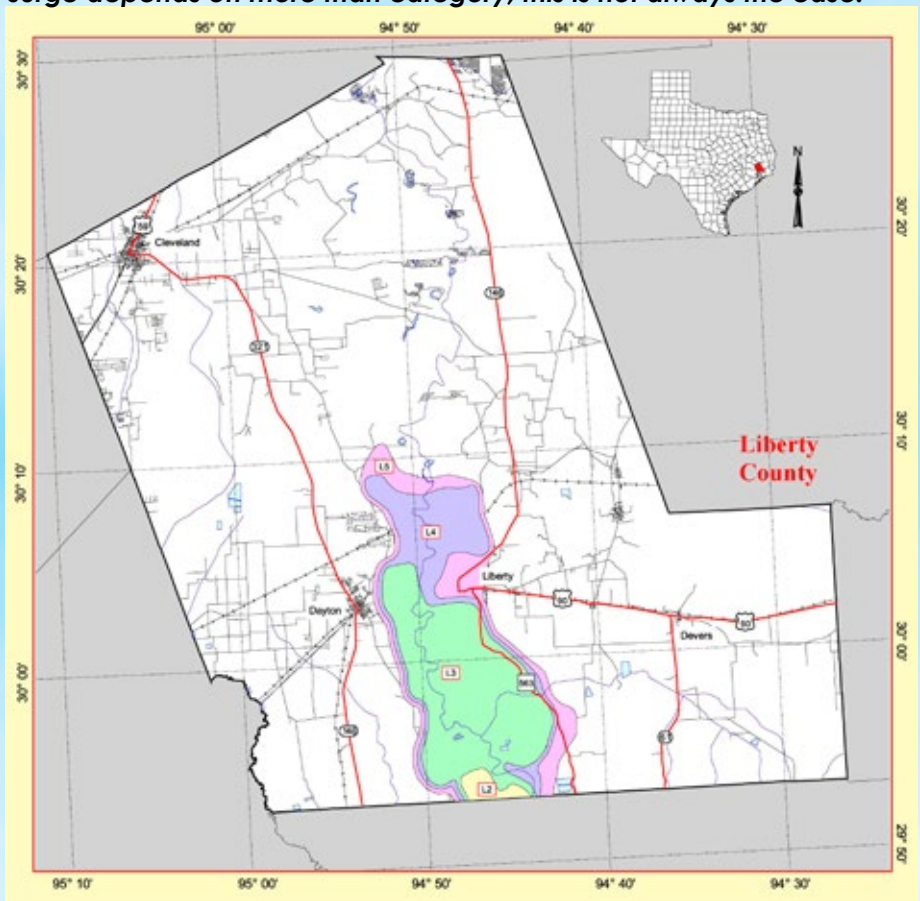
ZIP ZONE COASTAL				
77414s	77422s	77465s	77483	77534s
77541	77550	77551	77554	77563
77577s	77623			
ZIP ZONE A				
77058s	77510	77514s	77518	77539
77563	77565	77568	77573	77586
77590	77591			
ZIP ZONE B				
77058n	77059	77062	77414n	77422n
77465n	77507	77511	77514n	77515
77517	77523	77531	77534n	77546n
77546s	77566	77571	77577n	77597
77598				
ZIP ZONE C				
77011	77012	77013	77015	77023
77029	77034	77049	77061	77075
77087	77089	77430	77486	77502
77503	77504	77505	77506	77521
77530	77535	77536	77547	77562
77578	77580	77581	77583	77584
77587				

Route Designation

- Evacuation Corridors
- Evacuation Connections
- Other Roads
- County Boundary



Different colors/zones roughly correspond to surge flooding for different hurricane categories (J1 corresponds to cat 1, etc). However because surge depends on more than category, this is not always the case.



Expiration Date: December 31, 2015
Revised: April 21, 2015
Map Created by:
Houston-Galveston Area Council

Flooding

Photo: *Harris County Flood Control District*

Flooding from Heavy Rain

There are numerous examples of significant flooding caused by landfalling tropical cyclones in Texas. Storms with a slow forward motion are the most dangerous as heavy rains persist for a longer period of time. Tropical Storm Allison was such a storm. Allison meandered across Southeast Texas for several days in early June 2001, dumping 35 to 40 inches of rainfall in some areas. These extreme rainfall totals produced devastating flooding, especially across the Houston metropolitan area. Of the 23 deaths attributed to Allison in Texas, 20 were related to persons who drowned while driving or walking through flood waters.

Five Practical Ways to Protect Yourself From the Dangers of Flooding

- **Protect Your Personal Documents and Special Items**
  - ✓ *Store valuables in plastic tubs with locking tops*
  - ✓ *In case of evacuation, you should be able to secure and move all your valuables within 15 minutes*
- **Buy Flood Insurance: A Plan for Replaceable Items**
  - ✓ *The National Flood Insurance Program (NFIP) is available from an insurance agent or the NFIP. There will be a 30 day waiting period before policy goes into effect so the time to buy is before hurricane season. For more information see www.floodsmart.gov*
- **Flood Proof Your Home - Take Steps to Minimize Flood Damage**
  - ✓ *Shut off the main circuit breaker to prevent short circuiting and eliminate the threat of electrocution*
  - ✓ *Raise outside air conditioning units onto platforms above ground level*
  - ✓ *Store rarely used or expensive items in the attic or on high shelves*
- **Develop a Family Flood Plan**
  - ✓ *Develop a plan of action to keep from panicking during an emergency*
  - ✓ *Have an evacuation route and alternatives planned in the event you are asked to evacuate*
  - ✓ *Communicate your plans with friends or family outside of your home area*
  - ✓ *Know your risk. Is your home, business or school in a floodplain? Where is water likely to collect on the roadways you most often travel? What is the fastest way to get to higher ground? Knowing the answers to these questions ahead of time can save your life*
- **Never Drive on Flooded Roads**
  - ✓ *Driving into flooded roadways puts your life and the lives of others at risk*
  - ✓ *Unless you are in a flood plain and flood waters threaten you directly, you are probably safest staying at your current location and off the roadways*
  - ✓ ***If you encounter flood waters when driving, Turn Around, Don't Drown!***

Destructive Winds and Tornadoes

Above: *Wind damgage to home from Hurricane Alicia in August 1983.*

Hurricane force winds of 74 mph or more can destroy buildings, mobile homes, trees and power poles. Debris such as signs, roofing material, siding, and small items left outside become flying missiles in a hurricane. The strongest winds occur in a region of the hurricane called the eyewall. Wind gusts in the right side of the eyewall are the most destructive. Hurricane force wind gusts can be felt well inland, far from the coast, especially for stronger fast moving hurricanes.

It is imperative to ensure your home or business is well constructed to minimize the damage from the wind. See the Planning and Preparing section in this guide for cost effective home improvement tips that can help you reduce your damage from a hurricane.

MOBILE HOME RESIDENTS MUST EVACUATE!

- No mobile home or manufactured home - no matter how new it is - can provide safe shelter from hurricane force winds.
- Straps or other tie-downs ***will not*** protect a mobile home from the high winds associated with a hurricane.
- Mobile home residents ***must evacuate*** when told to do so by local authorities.

Tornadoes

Tropical cyclones can also produce tornadoes. These tornadoes most often occur in thunderstorms embedded in rain bands well away from the center of the hurricane; however, they can also occur near the eyewall. Tornadoes produced by tropical cyclones are relatively weak and short-lived, but still pose a threat. A tornado that developed in one of Hurricane Carla's outer bands killed 6 in Galveston in 1961.

Planning and Preparing

Preparing Your Home Before the Storm

Proper hurricane preparations made ahead of time will not completely protect your property from damage. However, following a few simple tips may greatly reduce the damage to your home and property.

Right: Hurricane clips attaching roof trusses to side walls.

Important Home Preparation Tips

Elevation Matters

- Know the elevation of your home! Are you in a surge, flood and/or evacuation zone?

Mobile Homes

- Check tie-downs for rust or breakage.
- Residents of mobile homes *must evacuate* when told to do so!

Landscaping

- Trim trees, shrubbery and dead limbs, especially ones close to your home.
- Repair or replace broken or damaged fences.
- Shredded bark is preferred instead of small gravel or stone bedding.

Roofing

- Inspect the roof for loose tiles, shingles or debris. Consider replacing old or damaged shingles with new ones rated for hurricane force winds.
- Check for and/or install hurricane clips to secure roof trusses to side walls.
- Clear loose and clogged rain gutters and downspouts.

Doors

- Reinforce garage doors and tracks or replace with a hurricane tested door. (See above image)
- Reinforce double entry doors with heavy duty foot and head bolts.
- Use a security dead bolt with a one inch minimum bolt length.
- Doors may be shuttered, but one entry must be left easily accessible.

Windows

- If possible, install tested/manufactured hurricane shutters.
- Inspect existing shutters to ensure they are in good working order.
- Alternative: Use 5/8" or greater exterior grade plywood secured by 2 1/2" screws and/or special clips. Obtain wood and fasteners, cut wood to size, pre-drill holes and place anchors on homes.
- Store shutters or plywood lying flat to avoid warping when not in use.

For more information on how to prepare your home visit www.flash.org

Planning and Preparing

Business and Employee Preparation

- Establish a temporary location for business operations in case your facility is damaged.
- Give employees enough time to secure their homes and families.
- Consider paying employees before they leave to prepare their homes.

Tips for Businesses

- Identify and protect vital records. Backup and store key files off site.
- Protect electronic equipment from possible water damage.
- Have extra cash and blank checks in case extra money is needed after the storm.
- Identify a safe room for employees who must remain in the building.
- Develop a 24-hour emergency contact with phone numbers of key employees.
- Set up telephone numbers for employees to check in and receive company information.

Protecting Your Boat - Marine Preparations

Tips for Boat Owners

- Check your marina contract for policies and procedures for hurricanes.
- Check with the manufacturer for proper ways to secure your boat during a storm.
- Consider moving arrangements well in advance of an approaching storm.
- Trailer boats should be removed from the water and securely stored at least 48 hours before a hurricane is expected to make landfall.
- Purchase necessary hurricane materials such as additional mooring lines, crew anchors, fenders, fender boards, chafing gear, and anchors.
- Safe storm moorings should consist of good condition ropes of sufficient diameter and length, with at least three or four substantial anchor points.
- Do not moor parallel to bank. Receding tides often capsize boats in this type of anchorage.

For Those Needing Extra Assistance

Preparations for People with Medical, Functional or Access Needs

FEMA News Photo

If you or someone you know have medical, functional or access needs, such as impaired vision, hearing loss, or limited mobility, it is important to make sure there is a support structure in place to help that person respond to a hurricane threat. Such individuals can often benefit from a caretaker or "hurricane helper," someone who can look out for that individual and ensure they have the necessary resources to evacuate and/or shelter when the storm threatens.

Important Tips

- Identify things you need every day such as food, medicines, water and other items you may rely on such as a walker, oxygen tanks or medical equipment. Start building up a supply before the hurricane season of non-perishable food items, bottled water, medicines, etc. that can be used in the event you lose power and/or water supply. Have at least two weeks' supply of food and water, and 1 month supply of medications. If you have vital medical equipment that you rely on that requires power, be sure to have a back-up source of power such as a battery or generator.
- Store important documents in a plastic bag such as prescriptions, emergency contact information for family and doctor, insurance cards, identification etc.
- If evacuation is necessary, identify where you will evacuate to, who you will stay with and how you will get there. If you cannot drive, make sure you have someone designated who will drive you where you need to go in advance of the hurricane. Make sure your transportation can accommodate any equipment or other supplies that need to be taken with you.

State of Texas Emergency Assistance Registry (STEAR) - Dial 211

2-1-1 TEXAS
Connecting People and Services

If you will need help evacuating from a hurricane or any other hazard, dial 2-1-1 to register in advance. You will be asked a series of questions which will allow emergency managers to identify those who need extra assistance evacuating. It is recommended to do this each calendar year. There is also an option to register online.

The City of Galveston has a separate "need a ride" number for their residents which is 409-621-3179. Once you register contact your emergency management office (pp.28-30) for more information on what type of assistance will be offered in your jurisdiction.

https://www.txdps.state.tx.us/dem/stear/public.htm
http://www.houstonoem.org/go/doc/4027/1130387/State-of-Texas-Emergency-Assistance-Registry

Preparing Pets and Livestock

Preparing for Your Pet's Safety

Your pet should be part of your overall hurricane preparation plans. Below are a few important things to help you prepare:

- Make sure your pet's vaccinations are current and have proof they are current. **DO NOT** assume that a public shelter or hotel will accept your pet.
- Be sure to have a current photo of your pet.
- Each animal should have a properly sized pet carrier. The carrier should be large enough for the animal to stand up and turn around.
- Make sure your pet has a proper ID collar.
- Pack enough food and bottled water for the duration of your evacuation. **DO NOT** let your pet eat food or drink water from outside that may have become contaminated.
- Be sure to pack all medications your pet may need along with a muzzle, collar, leash, paper towels, and trash bags.

Preparations for Livestock

- Ensure all animals have some form of visible identification.
- Evacuate animals whenever possible. Arrangements for evacuation, including routes and host sites, should be made in advance.
- The evacuation sites should have or be able to readily obtain food, water, veterinary care, handling equipment and facilities.
- Obtain vehicles and trailers needed for transporting each type of animal. Also make available experienced handlers and drivers.
- If evacuation is not possible, a decision must be made whether to move large animals to available shelter or turn them outside. This decision should be determined based on soundness and location of the shelter (structure).
- When necessary, move livestock to higher ground and deny access to flood prone pastures, barns, and other structures.
- It is important that livestock have plenty of food and clean water.

Insurance Tips

Insurance Tips - Before the Storm

- Keep a written inventory of your possessions. Take photos or videotape of each room and the exterior of your home to keep with your inventory.
- Gather important documents and insurance cards and policies. Unless they are stored in a safe place, take them with you if you evacuate along with an inventory of your possessions, including receipts and photos or videos.
- Know what your policy covers. Check your auto policy to see if you have comprehensive coverage "other than collision." Comprehensive coverage pays if a storm, fire, or flood damages your car. Find out how much coverage you have for "additional living expenses" to cover lodging, food, and other expenses if you're forced to vacate your residence after suffering a covered loss.
- Know your policy limits. Your limits may be too low if replacement costs have risen because of new additions, improvements, or inflation.
- Review your health coverage. Find out if you'll be able to receive non-emergency care from out-of-network providers, if needed, without accruing additional out-of-pocket costs.
- Consider renters insurance if you don't have it. If you rent an apartment, duplex, house, or townhouse, you may need renters insurance to protect your belongings.
- Consider purchasing flood, wind and hail coverage. You may have to buy separate policies to cover wind, hail, and flood damage. Homeowners, farm and ranch, renters, windstorm, and condominium policies do not cover damage from rising waters.

National Flood Insurance Program (NFIP)

Homeowners and commercial property policies specifically exclude coverage for damage from flooding from rising waters. To protect yourself from losses caused by most flooding, you'll need to purchase a separate flood insurance policy from the National Flood Insurance Program (NFIP)For more information about flood insurance, contact the NFIP 1-800-638-6620. **www.floodsmart.gov**

Texas Windstorm Insurance Association (TWIA)

If your property is located in one of Texas' 14 coastal counties, or parts of southeastern Harris County, you will likely only be able to obtain insurance coverage for windstorm or hail damage from a special insurance pool called the Texas Windstorm Insurance Association (TWIA.) To qualify for TWIA coverage, your property must pass a windstorm inspection and must meet certain windstorm-resistant building standards. You cannot buy or change TWIA coverage once a hurricane has entered the Gulf of Mexico. For more information about wind-storm coverage call TWIA or visit its website 1-800-788-8247. **www.twia.org**

Insurance Tips - After the Storm

Contact your insurance agent or company promptly. Keep a record of all contacts you have with your company. Be prepared to answer questions about the extent and severity of the damage.

If your home is not insured, contact your local Red Cross or FEMA Disaster Recovery Center for assistance. Call FEMA at 1-800-621-FEMA (3362).

Make a list of your damaged property. Photograph or videotape the damage if possible. Don't throw away damaged items until your insurance adjuster has had a chance to view them.

If there is partial damage to your home, take reasonable and necessary repairs to protect your home and property from further damage. Cover broken windows and holes to keep rain out. Don't make permanent repairs until instructed by your insurance company. Keep a record of your repair expenses and save all receipts.

Texas Department of Insurance
www.tdi.texas.gov
Consumer help line 1-800-252-3439

Texas Windstorm Insurance Association
www.twia.org
Consumer help line 1-800-788-8247

Contacts and Disaster Supply Kit

The Greater Houston Area Chapter of the American Red Cross recommends that you have the following items in your Hurricane Supply Kit. Do not forget to have a family meeting before hurricane season and review your communication information and evacuation plan. Make sure the contact information such as home, work, school, cell phone numbers, and your "Out of Town" contact person's information is current.

Emergency Contact Information

Out of Town Contact Address: _____

Out of Town Contact Phone Number: _____

Work Telephone Number: _____

Cell Number/Spouse Cell Number: _____

Children Cell Number: _____

School Telephone Number: _____

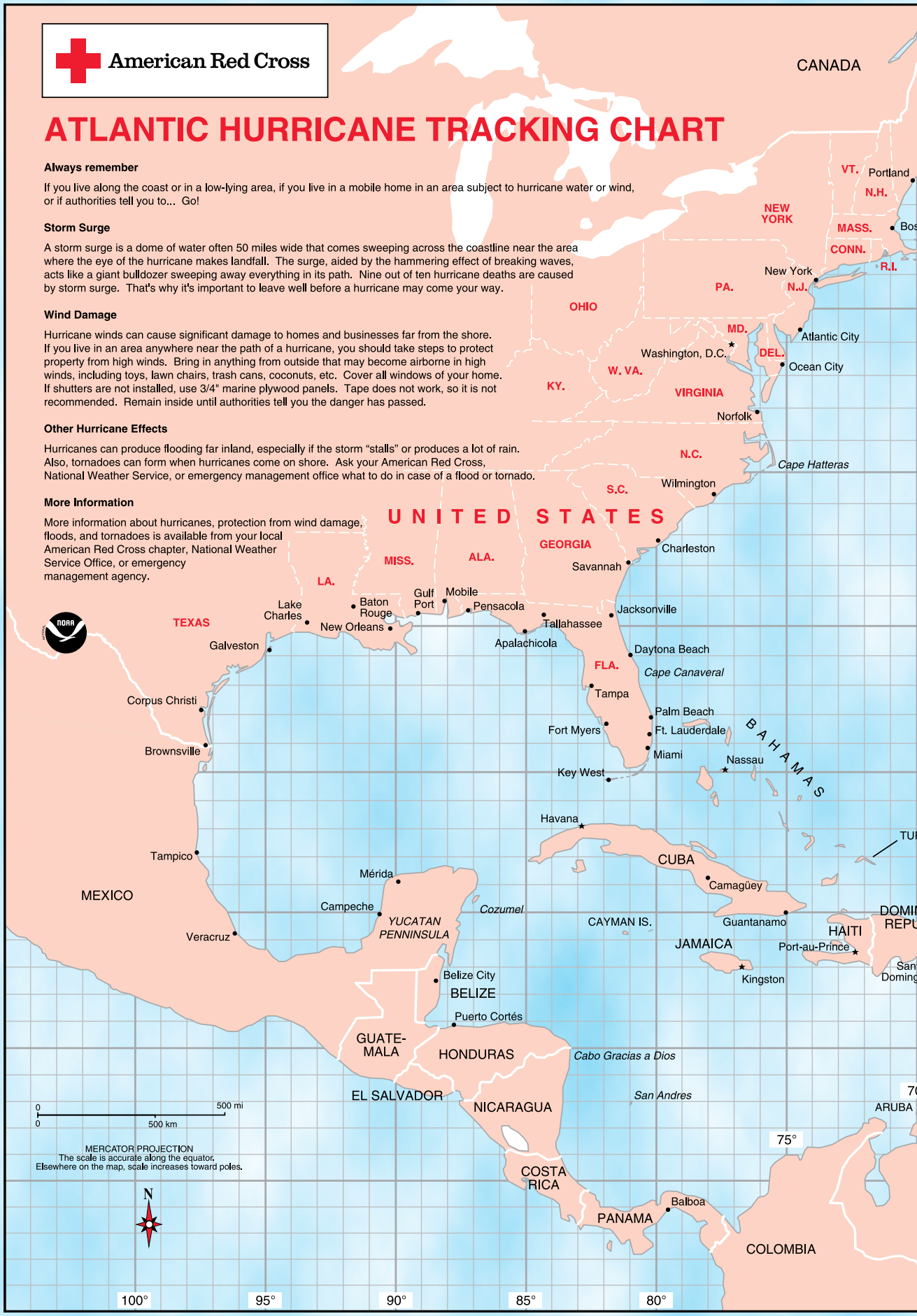
Doctor Telephone Number: _____

Bank/Credit Card Telephone Number: _____

Insurance Company Information: _____

HURRICANE SUPPLY KIT

- At least a 7-day supply of non-perishable food and a manual can opener
- At least a 7-day supply of water. One gallon per person per day is recommended
- Battery powered portable television or radio with extra batteries
- Flashlight with extra batteries
- First Aid kit and manual
- Sanitation and hygiene items such as instant hand sanitizing gel, moist towelettes, toilet paper, and feminine hygiene products
- Matches in a waterproof container
- Whistle
- Kitchen accessories and cooking utensils
- Cash
- Extra clothing, blankets, and sleeping bags
- Photocopies of identification, insurance, prescriptions, household inventory, credit cards, and your latest utility bill
- CD or photocopies of important documents such as birth/marriage certificates and titles
- Prescription medications, eyeglasses, contact lens solution, and hearing aid batteries
- Formula, baby food, diapers, and pacifiers
- Pet carriers, leashes, shot records, and food for each animal evacuating with you
- A good map showing county roads and highways
- Tire repair kit, booster cables, pump, and flares
- White distress flag
- Toys and games for children
- List of family phone numbers and addresses outside the area


American Red Cross
ATLANTIC HURRICANE TRACKING CHART
Always remember
If you live along the coast or in a low-lying area, if you live in a mobile home in an area subject to hurricane water or wind, or if authorities tell you to... Go!
Storm Surge
A storm surge is a dome of water often 50 miles wide that comes sweeping across the coastline near the area where the eye of the hurricane makes landfall. The surge, aided by the hammering effect of breaking waves, acts like a giant bulldozer sweeping away everything in its path. Nine out of ten hurricane deaths are caused by storm surge. That's why it's important to leave well before a hurricane may come your way.
Wind Damage
Hurricane winds can cause significant damage to homes and businesses far from the shore. If you live in an area anywhere near the path of a hurricane, you should take steps to protect property from high winds. Bring in anything from outside that may become airborne in high winds, including toys, lawn chairs, trash cans, coconuts, etc. Cover all windows of your home. If shutters are not installed, use 3/4" marine plywood panels. Tape does not work, so it is not recommended. Remain inside until authorities tell you the danger has passed.
Other Hurricane Effects
Hurricanes can produce flooding far inland, especially if the storm "stalls" or produces a lot of rain. Also, tornadoes can form when hurricanes come on shore. Ask your American Red Cross, National Weather Service, or emergency management office what to do in case of a flood or tornado.
More Information
More information about hurricanes, protection from wind damage, floods, and tornadoes is available from your local American Red Cross chapter, National Weather Service Office, or emergency management agency.
CANADA
VT.
Portland
N.H.
NEW YORK
MASS.
CONN.
R.I.
New York
PA.
N.J.
OHIO
MD.
Atlantic City
Washington, D.C.
DEL.
Ocean City
W. VA.
KY.
VIRGINIA
Norfolk
N.C.
Cape Hatteras
S.C.
Wilmington
UNITED STATES
GEORGIA
Charleston
MISS.
ALA.
Savannah
LA.
Gulf Port
Mobile
Pensacola
Jacksonville
Lake Charles
Baton Rouge
New Orleans
TEXAS
Tallahassee
Galveston
Apalachicola
Daytona Beach
FLA.
Cape Canaveral
Tampa
Corpus Christi
Palm Beach
Fort Myers
Ft. Lauderdale
Brownsville
Miami
BAHAMAS
Nassau
Key West
Havana
Tampico
CUBA
Mérida
Camagüey
MEXICO
Campeche
Cozumel
CAYMAN IS.
Guantanamo
YUCATAN PENNINSULA
HAITI
Veracruz
JAMAICA
Port-au-Prince
Kingston
Belize City
BELIZE
Puerto Cortés
GUATE-MALA
HONDURAS
Cabo Gracias a Dios
EL SALVADOR
NICARAGUA
San Andres
ARUBA
0
500 mi
0
500 km
MERCATOR PROJECTION
The scale is accurate along the equator.
Elsewhere on the map, scale increases toward poles.
N
75°
COSTA RICA
Balboa
PANAMA
COLOMBIA
100°
95°
90°
85°
80°


2015 Hurricane Names
☐ Ana
☐ Bill
☐ Claudette
☐ Danny
☐ Erika
☐ Fred
☐ Grace
☐ Henri
☐ Ida
☐ Joaquin
☐ Kate
☐ Larry
☐ Mindy
☐ Nicholas
☐ Odette
☐ Peter
☐ Rose
☐ Sam
☐ Teresa
☐ Victor
☐ Wanda
NEW BRUNSWICK
NEWFOUNDLAND
MAINE
NOVA SCOTIA
BERMUDA
30°
25°
20°
15°
10°
65°
60°
55°
50°
45°
40°
BRITISH VIRGIN IS.
San Juan
ANGUILLA
ST. MARTIN
ST.-BARTHÉLEMY
PUERTO RICO (U.S.)
U.S. VIRGIN ISLANDS
ST. KITTS and NEVIS
ANTIGUA
GUADELOUPE
DOMINICA
MARTINIQUE
ST. LUCIA
ST. VINCENT and THE GRENADINES
BARBADOS
CURACAO
GRENADA
TOBAGO
TRINIDAD
VENEZUELA
GUYANA

Hurricane Forecast Resources

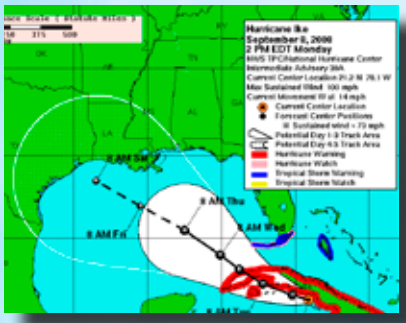
The National Hurricane Center (NHC) in Miami, FL is the official source for tropical cyclone advisories and forecasts and is responsible for issuing tropical cyclone watches and warnings for the United States.

Weather Information

National Weather Service
www.weather.gov/houston
National Hurricane Center
www.hurricanes.gov

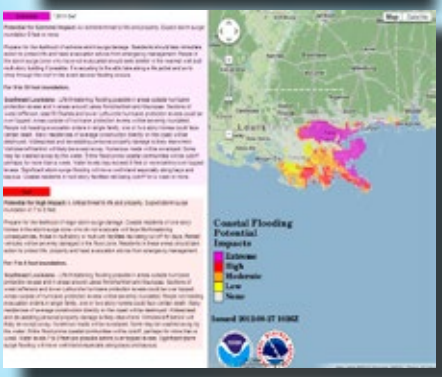
Graphical Tropical Weather Outlook

- Provides an overview of all tropical cyclone activity.
- Indicates areas of interest where tropical cyclones could develop over next 5 days. A percent chance that it will develop is assigned.
- Moving the cursor over the highlighted areas will provide a more detailed text description.



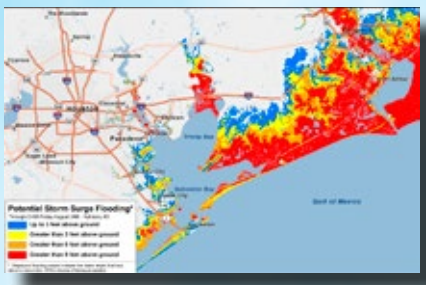
NHC Forecast Advisory

- Most recent position for a storm along with all coastline watches and warnings. Includes a 3 or 5 day track with error cone.
- Error cone represents a 5 year average error. Storms only stay within the error cone 67% of the time.
- DO NOT focus too closely on the exact track forecast - the little black line. If you are in or near the cone, the center of the storm could head your way. Impacts are often felt outside the cone entirely.



Tropical Cyclone Potential Impact Graphics

- Colorized maps showing different threat levels for each hazard (damaging winds, storm surge flooding, tornadoes and rainfall flooding)
- Threats levels rated as none, low, moderate, high and extreme. A key or legend explains the meaning of each threat level in terms of expected impacts.
- For more information go to http://www.weather.gov/tcig.



Potential Surge Inundation graphic

- Issued by National Hurricane Center within 48 hours of landfall.
- Shows reasonable worse case for the amount of flooding from ocean water surging over land. Data is plotted as depth of water above ground.

Final Checklist

Actions to Take When a Storm is in the Gulf

- Listen frequently to radio, TV, or NOAA weather radio for bulletins and forecasts of the storm's progress.
- Double check items in your emergency supply kit.
- Fuel and service your vehicles.
- Inspect and secure mobile home tie-downs.
- Make sure you have supplies to survive on your own for at least one week if you plan on staying.
- Board up windows (if shutters do not exist) in case storm moves quickly and you have to leave. **TAPE PROVIDES NO PROTECTION**!
- Store lawn furniture and other loose, light weight objects, such as garbage cans and garden tools.
- Get plenty of extra cash in case power goes out and ATMs do not work.
- Garage or store vehicles that are not being used.
- Follow instructions issued by local officials. **EVACUATE IMMEDIATELY IF ORDERED TO DO SO**!

Final Actions to Take if Leaving

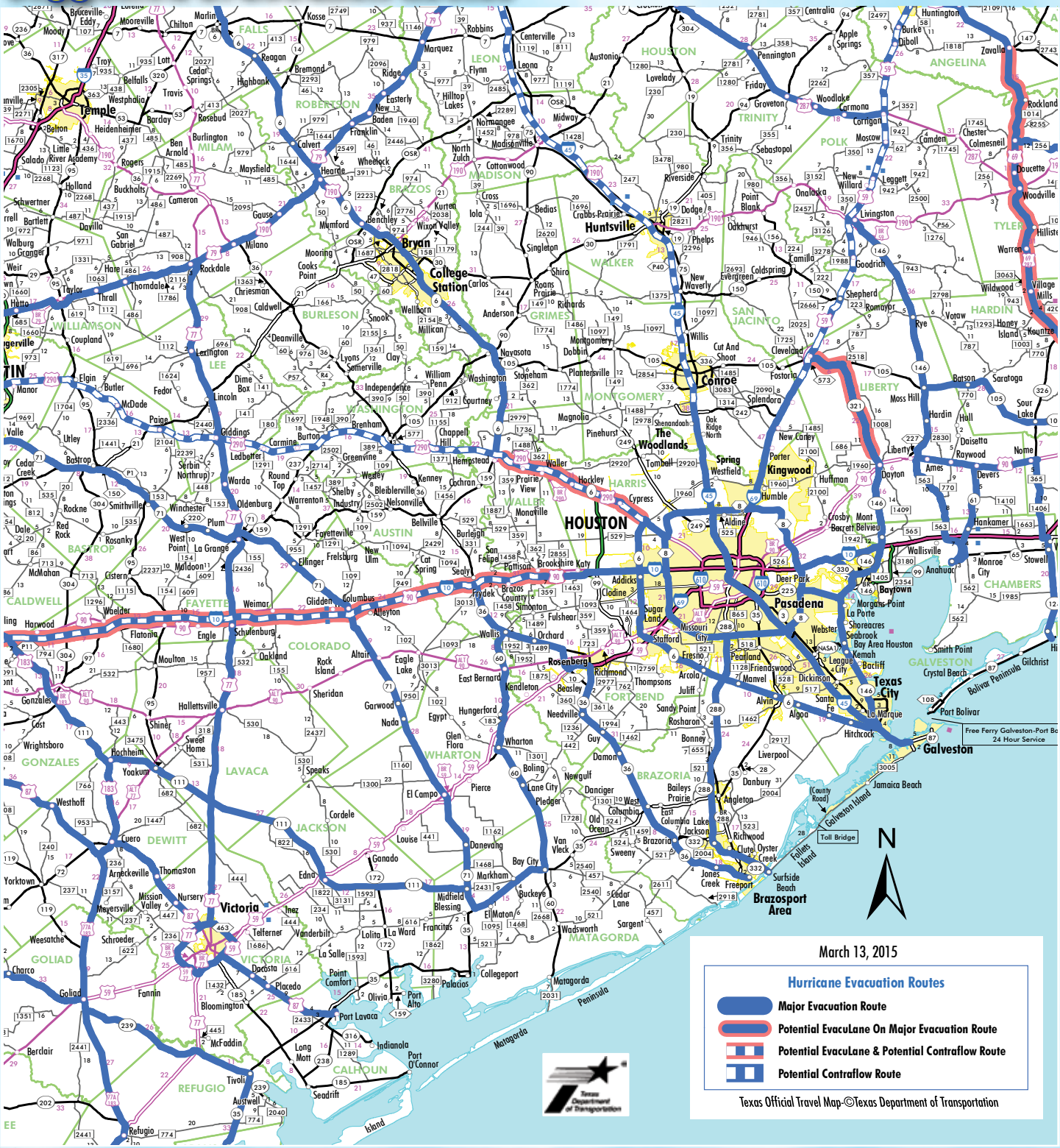
- Turn off propane tanks.
- Unplug small appliances.
- Turn refrigerator and freezer to lowest setting.
- Turn off utilities if ordered to do so.
- Notify family members of your evacuation plans.
- Lower water level in swimming pool by one foot.
- Lock home securely.
- Board up remaining doors and brace garage door.
- Take pets with you.

Final Actions to Take if Staying

- Close storm shutters.
- Turn refrigerator or freezer to coldest setting and open only if necessary.
  (25 pounds of dry ice will keep a 10-cubic foot freezer below freezing for 3-4 days.)
- Follow instructions from emergency managers and be prepared to turn off utilities if ordered to do so.
- Board up remaining doors, brace garage door, and remain inside. Stay away from boarded up windows.
- Beware of the calm winds in the eye of the storm and do not venture outside. Some of the strongest winds may occur shortly after the eye passes.
- **DO NOT EXPECT EMERGENCY RESPONDERS TO BE OF ANY ASSISTANCE DURING A LANDFALLING HURRICANE!**

Evacuation

Suggested Evacuation Routes



For detailed evacuation map click here: http://ftp.dot.state.tx.us/pub/txdot-info/trv/evacuation/houston.pdf

Evacuation

Evacuees need to consider the projected path of the hurricane when choosing an evacuation route and destination. Evacuation studies estimate that it takes between 23 and 42 hours to evacuate southeast Texas in advance of tropical storm force winds. This underscores the need for coastal residents to have an evacuation plan. When evacuating, be sure to check local weather and highway conditions before departing. When local authorities order an evacuation of your area, leave immediately!

Texas Road Information

TXDOT Road Conditions

1-800-452-9292 or **www.txdot.gov**

drivetexas.org

Final Actions before Evacuating

- Follow evacuation orders provided by your local officials. Once the evacuation order has been given, leave as soon as possible to avoid heavy traffic and hazardous weather.
- Take your Hurricane Supply Kit with you (as described on page 15).
- Do not stay in a mobile home near the coast under any circumstance.
- See TXDOT map on the previous page for an illustration of evacuation routes.
- Prepare to stay at your evacuation destination for a week or more if necessary, as re-entry into the affected area may be restricted.

Returning Home

IF YOU EVACUATED THE AREA, WAIT FOR AN ALL CLEAR FROM THE CITY OR COUNTY BEFORE ATTEMPTING TO RETURN TO YOUR HOME.
BE PREPARED TO SHOW PROOF OF RESIDENCE.

FEMA News Photo

General Cleanup

- Be cautious of structural damage and downed power lines. Do not attempt to move structural supports or large pieces of debris.
- DO NOT run power generators indoors. Inhalation of carbon monoxide from the exhaust can cause death. Ensure exhaust is well ventilated.
- DO NOT use open flames indoors.
- Restrict your driving to emergency use only. Road conditions may not be safe until road debris is cleared.

FEMA News Photo

Debris Cleanup

- Cities and counties will publish a schedule for debris pick-up and removal. Debris cannot be removed from private property.
- Construction materials, vegetative debris, household hazardous waste and household appliances will need to be placed into ***separate piles*** and moved to the curbside for pick-up.
- Consider sharing piles with neighbors.
- Do not set debris against trees or poles. Do not cover up fire hydrants or mail boxes. Doing so makes it harder for cleanup crews to scoop up the items.

For more information:
http://nepis.epa.gov/Adobe/PDF/P1008EKA.PDF

Water

- Listen for instructions regarding public water supply. Use only bottled, boiled or treated water until you know that your water supply is safe.
- You can purify water by boiling for one minute then letting it cool before drinking.

Returning Home

Utility Cleanup

FEMA News Photo

- Check for gas leaks. If you smell or hear gas leaking, leave immediately. DO NOT use the phone or turn on lights in your home. Call the gas company from a neighbor's phone.
- Report any visible damage of power lines to the electric company. Turn off power at main breaker if any electrical equipment or circuits have been exposed to water.
- DO NOT connect generators to your home's electrical circuits. If a generator is on line when electrical service is restored, it can become a major fire hazard. Also, line workers working to restore power will be endangered if a generator is hooked up to the home's circuits.
- It is likely that an electric company other than your own will reconnect the lines to your home; however, they can not turn the service back on. Only your electric company can actually turn the power back on to your house.

Sewage Cleanup

- If you suspect water or sewage lines are damaged, do not use your plumbing (toilets, sinks, etc.). Contact the water company or a plumber for repairs.
- A chemical portable commode can be created by the following:
  - ✓ Use 5 gallon buckets with tight lids, lined with heavy duty plastic garbage bags.
  - ✓ Add kitty litter to the bucket as a disinfectant and deodorizer. Keep lids on firmly.
  - ✓ Keep buckets in a cool, dark place. Clean and disinfect buckets immediately.
- Your toilet can also be used by flushing until the bowl has no water. Then, line with heavy duty trash bags and disinfect with chlorine bleach after each use. Remove waste to an outside location.
- If significant sewer outages have occurred, instructions for disposal of human wastes will be announced.
- DO NOT dispose of human waste through your regular trash!

Interior Cleanup

- Disinfect and dry interior buildings and items inside. This will prevent growth of some bacteria, viruses, mold, and mildew that can cause illness.
- Clean walls, floors, and counter tops with soap and water. Disinfect them with a solution of 1 cup of bleach to 5 gallons of water.
- Wash all clothes and linens in hot water. Air dry and spray all unwashable items with disinfectant. Steam clean carpets. Throw away all items touched by water that cannot be disinfected.

A Look Back at Hurricane Rita 10 Years Later

The date was Wednesday September 21st 2005. Just a few weeks earlier the nation watched in horror as Hurricane Katrina devastated the Gulf Coast, from Louisiana to the Florida Panhandle, with high winds and catastrophic storm surge flooding. Katrina was responsible for the third largest loss of life from any U.S. hurricane with an estimated 1200 fatalities. The storm also led an estimated 400,000 evacuees to shelter in Texas. Now Hurricane Rita, with its category 5 rating and estimated 175 mph sustained winds, was forecast to track toward the Texas coast with the threat of catastrophic winds and surge to areas including the Houston/Galveston region. At 4 pm on Wednesday September 21st nearly the entire Texas coast was placed under a hurricane watch (figure 1) with the onset of high winds and rising waters from surge expected by Friday. Given the experience of seeing what happened with Katrina and providing shelter for hundreds of thousands of evacuees, the stage was set for a complex, massive evacuation of coastal Texas residents ahead of Rita.

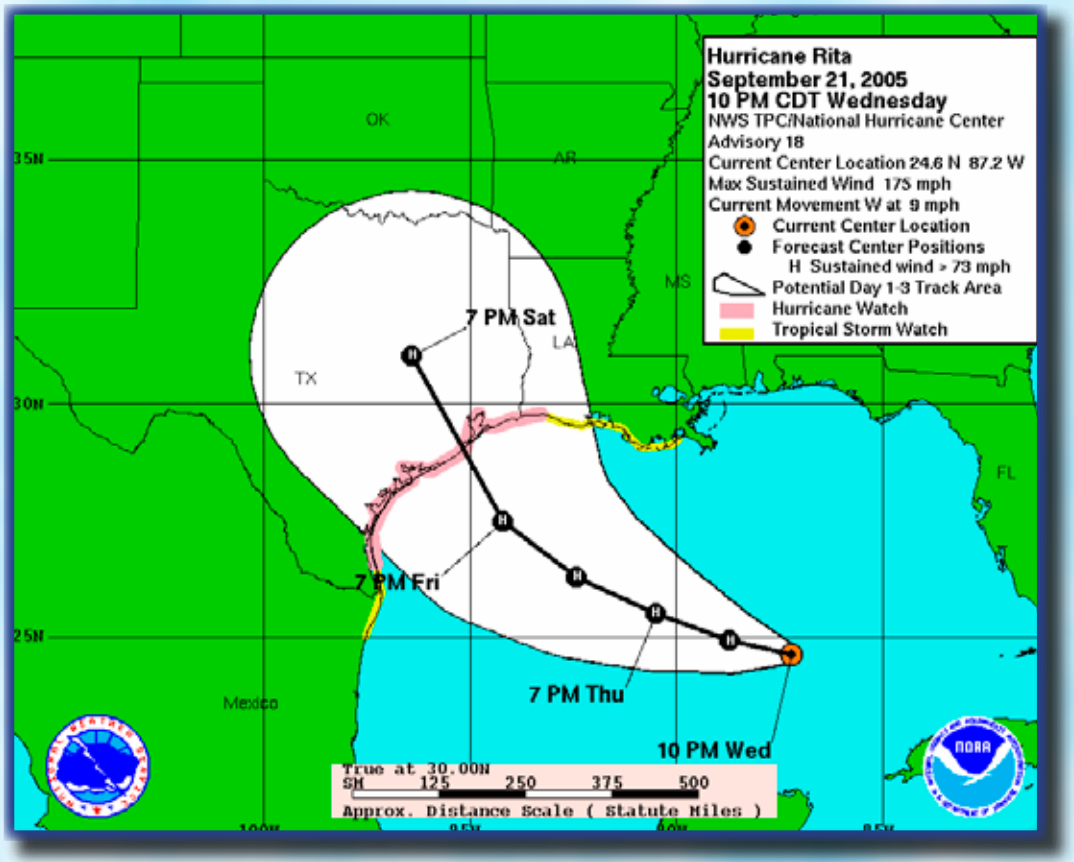


Figure 1. Category 5 Hurricane Rita forecast track at 10 pm CDT Sept. 21, 2005. Pink line shows area under Hurricane Watch at this time.

On September 20th an evacuation was ordered for 3 million residents in Chambers, Galveston and Harris Counties. The numbers that evacuated were likely much higher given the fear of Rita and the category 5 strength and forecast track that were evident on the 21st. The result was gridlock on major evacuation routes from coastal areas to those inland like Dallas and San Antonio. Car trips that would normally would take 3 to 4 hours took 18 to 24 hours. Interstate 45 north of Houston was backed up for 30 miles. The traffic congestion and lack of access to fuel caused many to run out of gas. This further contributed to the traffic problems. The extreme heat, lack of access to food, water and comfort

stations led to discomfort and health problems for some. Those on the major evacuation routes were in some cases prevented from exiting those routes. The traffic congestion made it difficult for medical personnel to reach those in distress.

Since Rita, state and local officials have made many changes to the way evacuations are handled. The Houston/Galveston Area Council (HGAC) took written plans and converted them into easy to understand maps. With input from local jurisdictions they developed evacuation zone maps by zip code to allow for partial or phased evacuations based on storm surge risk. The State modified their plans to allow for more flexibility for evacuees to allow them to take alternate roads while also surging resources (fuel, comfort stations) to designated evacuation routes. The State also will now, when

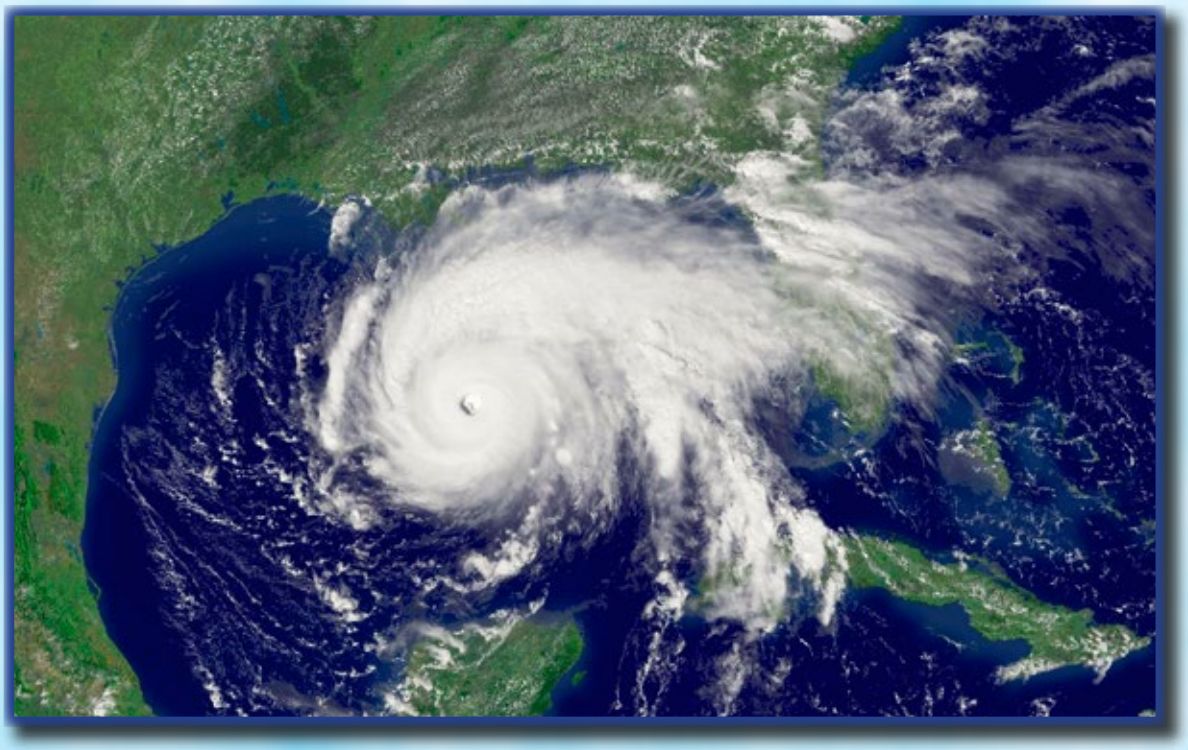


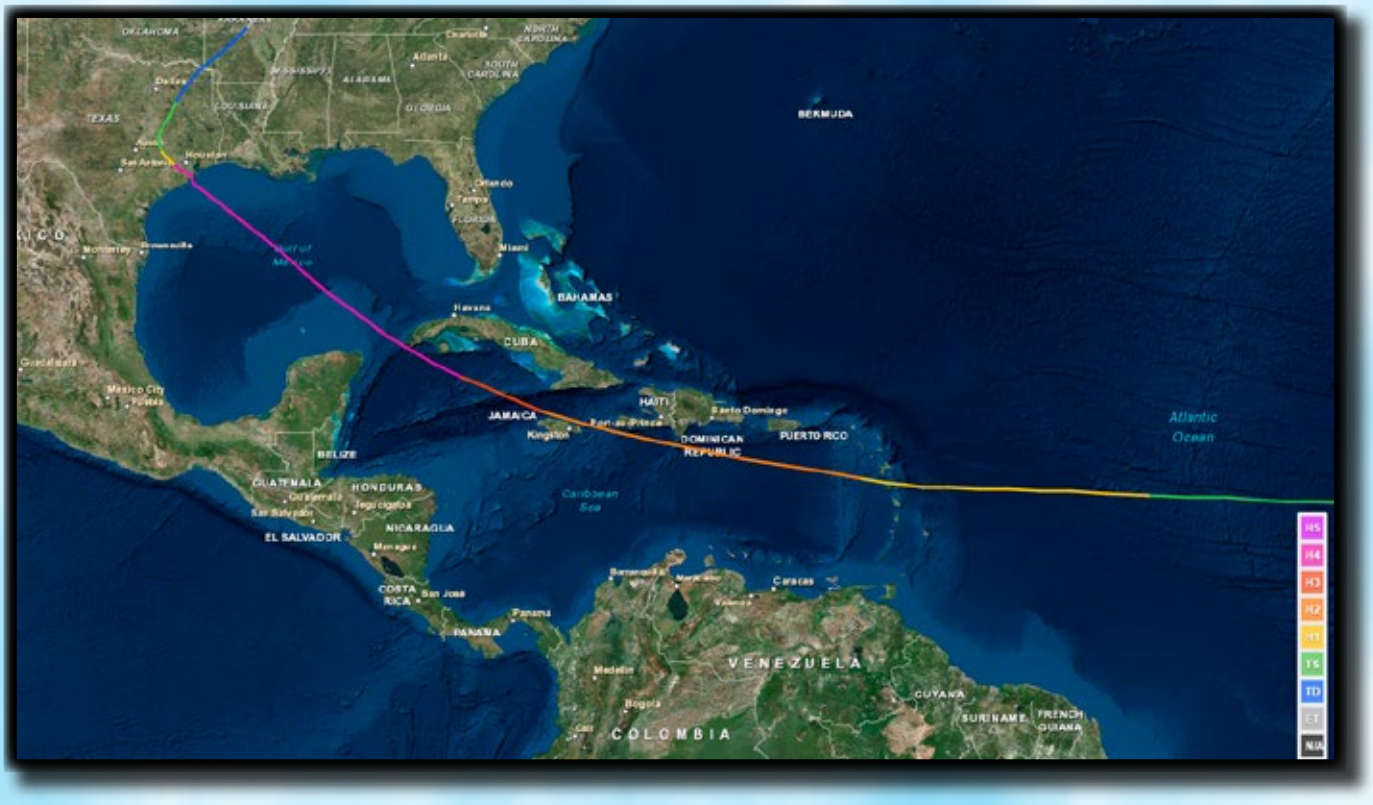
Figure 2. Hurricane Rita at 1:45 PM CDT Sept. 22, 2005 (NOAA).

possible, secure additional busses and drivers for local jurisdictions who are undertaking evacuation of citizens to designated inland sister cities. Efforts to identify and assist those with functional and access needs and those that are lacking transportation intensified and led to the development of the STEAR program today and other local efforts such as H-GAC Together Against the Weather campaign. The changes put in place after Rita, increased public education campaigns, and the memory of the difficulties in evacuating for Rita are believed to have contributed to a much smoother more efficient evacuation ahead of Hurricane Ike. As the Houston-Galveston area continues to grow at a rapid rate evacuation ahead of a major hurricane remains a big concern. Emergency plans continually evolve to address the challenges.

1915 Galveston Hurricane

Lance Wood

One hundred years ago, in August 1915, the city of Galveston faced another powerful Category 4 hurricane. Those who had survived the 1900 Storm still remembered the devastation and horror that storm brought; however, this time, they were more prepared. In the wake of the 1900 Storm, residents of Galveston were determined to rebuild, and to protect the city from subsequent storms. Three engineers (Alfred Noble, Henry M. Robert and H.C. Ripley) recommended building a seawall and raising the city behind it. Their protection plan included a seawall reaching 17 feet high (relative to the mean low tide), with the elevation of the city sloping downward at a pitch of one foot for every 1,500 feet from the seawall toward the bay. In order to raise the city, the Galveston ship channel was dredged with a sandy sludge pumped under raised sewer lines, water lines, power lines, and buildings – a monumental task. The grade raising took many years, and was not completed until 1910. Construction on the city's section of the seawall was not as lengthy, and was completed in 1904. The large and powerful 1915 hurricane would be the first major test of these mitigation efforts.



Beginning in the Atlantic Ocean as a tropical depression, the tropical cyclone gained strength as it entered into the far eastern Caribbean Sea. Reports came in from Barbados and Dominica on August 10th of a storm heading towards the west. When the storm reached the western edge of Cuba, after tracking south of Puerto Rico and Haiti, it had intensified into a very powerful hurricane. The S.S. Antilles reported hurricane force easterly winds via radio at a position of 27 degrees N latitude and 86 degrees W longitude at 2 PM on Sunday, August 15th. By 5 PM, hurricane warnings were ordered for the western Gulf stations all the way to Brownsville, Texas. The hurricane continued its northwest movement across the northwest Gulf on Monday, August 16th, with winds and water levels increasing at Galveston during the day. By 8 PM, the pressure at Galveston had fallen to 29.10 inches with northeast winds now approaching hurricane strength. The hurricane made landfall southwest of Galveston overnight with a

1915 Galveston Hurricane

Lance Wood

maximum sustained wind of 93 mph and a maximum gust of 120 mph reported at Galveston. To the southwest, closer to the landfall location, the lowest recorded pressure of 28.06 inches was measured by E.F. Roeller at Velasco, Texas (14 miles southwest of San Luis Pass), at 1 AM on August 17th.

After the hurricane, press reports and letters indicated that warnings issued by the Weather Bureau were the most complete and successful ever issued for a tropical cyclone. Mr. W. P. Stewart, official in charge of the Galveston Weather Bureau, gave his thoughts concerning the importance of radio communication and observation sites in the Caribbean: "In very large measure the success in forecasting the path and rate of movement of the storm was rendered possible by the splendid radio service which has become a valuable adjunct of Weather Bureau forecast work since the last severe tropical storm. The distribution of the warnings was as widespread and complete as human energy could make them, and this service undoubtedly saved many lives and a considerable amount of property. It was fortunate also for all concerned that during the first four days of the storm its center was close to the stations of observation to enable the forecaster to indicate its velocity of movement." An editorial in the Union and Advertiser (Rochester, N.Y.) appropriately noted the importance of both warnings and the seawall: "Only Galveston's seawall was more effective than the Government Weather Bureau in preventing a repetition of the disaster of 1900". Concerning the storm surge level and associated damage, Stewart noted, "It appears to be the universal opinion that the water was somewhat higher than in 1900. Of the 250 homes on Galveston Island outside the protection of the seawall probably not over 10 percent are left standing. That there were not more fatalities in that section was due solely to the warnings of the weather Bureau." The fact that there were less than 300 casualties with the 1915 hurricane, makes it clear that thousands of lives were saved by improved communication and a remarkable mitigation effort by the people of Galveston after the 1900 Storm.

Acknowledgements:
Kat Cobb, Atmospheric Science Student -TAMU
Courtesy of Rosenberg Library, Galveston, Texas

References:
The Tropical Storm of August 10, 1915, H.C. Frankenfield, Monthly Weather Review
Galveston's Response to the Hurricane of 1900, Texas State Historical Association
Post-storm rebuilding considered 'Galveston's finest hour', Michael Smith,
The Daily News, City of Galveston 1900 Storm Committee

Emergency Management Contacts

AUSTIN

- County Emergency Management
  979-865-5911

BRAZORIA

- County Emergency Management
  979-864-1201
  www.readybrazoria.us
- Alvin
  281-388-4363
- Angleton
  979-849-2383
- Bailey's Prarie
  979-849-0134
- Brazoria
  979-798-2489
- Brookside
  281-997-9777
- Clute
  979-265-6194
- Danbury
  979-922-1551
- Freeport
  979-239-1211
- Hillcrest Village
  281-748-7149
- Jones Creek
  979-233-3091
- Lake Jackson
  979-415-2500
- Liverpool
  281-581-2342
- Manvel
  281-489-1212
- Oyster Creek
  979-233-8481
- Pearland
  281-997-4650
  cityofpearland.com/prepredness
- Richwood
  979-265-8157
- Surfside
  979-239-1151
- Sweeney
  979-548-3321
- Quintana
  979-233-0848
- West Columbia
  979-345-5121

BRAZOS

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  979-821-1011
  www.bcdem.org
- Bryan
  979-821-1030
  www.bryantx.gov
- College Station
  979-764-5210
  www.cstx.gov/dem

BURLESON

- County Emergency Management
  979-567-2008

CHAMBERS

- County Emergency Management
  409-267-2445
  www.co.chambers.tx.us

COLORADO

- County Emergency Management
  979-733-0184

FORT BEND

- County Emergency Management
  281-342-6185
  www.fbcoem.org
- Arcola
  281-431-0606
- Beasley
  979-387-2775
- Fairchilds
  979-793-6676
- Fulshear
  281-346-1796
- Kendleton
  832-439-1524
- Meadows Place
  281-983-2900
- Missouri City
  281-403-8500
  www.missouricityready.com
- Needville
  979-793-4255
- Orchard
  979-478-6893
- Pleak
  281-239-8504
- Richmond
  281-232-6871
- Rosenberg
  835-595-3700
  www.ci.rosenberg.tx.us
- Simonton
  281-496-0066
- Stafford
  281-261-3950
- Sugar Land
  281-275-2853
  sugarlandresponds.com
- Thompsons
  281-343-9929
- Weston lakes
  281-533-0907

Emergency Management Contacts

GALVESTON

- *County Emergency Management*
  888-384-2000
  www.gcoem.org
- *Bayou Vista*
  409-935-0449
- *Clear Lake Shores*
  281-334-1034
  281-334-2799
- *Dickinson*
  281-337-4700
- *Friendswood*
  281-996-3335
- *Galveston*
  409-765-3710
  www.cityofgalveston.org
- *Hitchcock*
  409-986-5559
  www.hitchcockpd.com
- *Jamaica Beach*
  409-737-1142
  www.ci.jamaicabeach.tx.us
- *Kemah*
  281-334-5414
- *La Marque*
  409-938-9269
  www.cityoflamarque.org
- *League City*
  281-554-1000
  www.leaguecity.com
- *Santa Fe*
  409-925-3092
- *Texas City*
  409-643-5840
- *Tiki Island*
  409-935-1427

GRIMES

- *County Emergency Management*
  936-873-4404

HARRIS

- *County Emergency Management*
  713-881-3100
  www.readyharris.org
- *Baytown*
  281-420-6556
  www.oembaytown.org
- *Bellaire*
  713-662-8222
- *Deer Park*
  281-478-7298
  www.deerparktx.gov
- *El Lago*
  281-326-5900
- *Galena Park*
  713-672-2556
- *Houston*
  713-884-4500
  www.houstonoem.org
- *Jacinto City*
  713-674-8424
- *Humble*
  281-446-4928
- *Jersey Village*
  713-466-2100
- *Katy*
  281-574-8633
  281-391-3500
  www.cityofkaty.com
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  281-470-0010
  www.lpoem.org
- *Morgan's Point*
  281-471-2171
- *Nassau Bay*
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- *Pasadena*
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- *Seabrook*
  281-291-5700
- *Shoreacres*
  281-471-2244
- *South Houston*
  713-947-7700
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- *Tomball*
  281-290-1301
- *Webster*
  281-332-1826

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- *County Emergency Management*
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- *Edna*
  361-782-3122
- *Ganado*
  361-771-2800

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- *County Emergency Management*
  936-334-3219
  www.co.liberty.tx.us
- *Cleveland*
  281-592-2667
- *Dayton*
  936-258-7621
- *Liberty*
  936-336-8118

Madison

- *County Emergency Management*
  936-348-3810
  www.co.madison.tx.us

MATAGORDA

- *County Emergency Management*
  979-323-0707
  www.co.matagorda.tx.us

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- *County Emergency Management*
  936-523-3901
  www.mctxoem.org
- *Conroe*
  936-522-3200
- *Shenendoah*
  281-367-8952

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  936-327-6826
  www.oem.polk.tx.us
- *Alabama-Coushatta*
  936-563-1100

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- *County Emergency Management*
  936-653-3395
  www.co.san-jacinto.tx.us

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- *County Emergency Management*
  936-435-2418
  www.walker.tx.us

WALLER

- *County Emergency Management*
  979-826-8282

WASHINGTON

- *County Emergency Management*
  979-337-1412
- *Brenham*
  979-337-7300

WHARTON

- *County Emergency Management*
  979-532-1123
  co.wharton.tx.us
- *El Campo*
  979-543-5311
- *Wharton*
  979-532-3131
  www.cityofwharton.com

US Department of Homeland Security

www.ready.gov

Red Cross

www.redcross.org
National - 800-733-2767
Gulf Coast Assistance Line 866-526-8300

FEMA

www.fema.gov

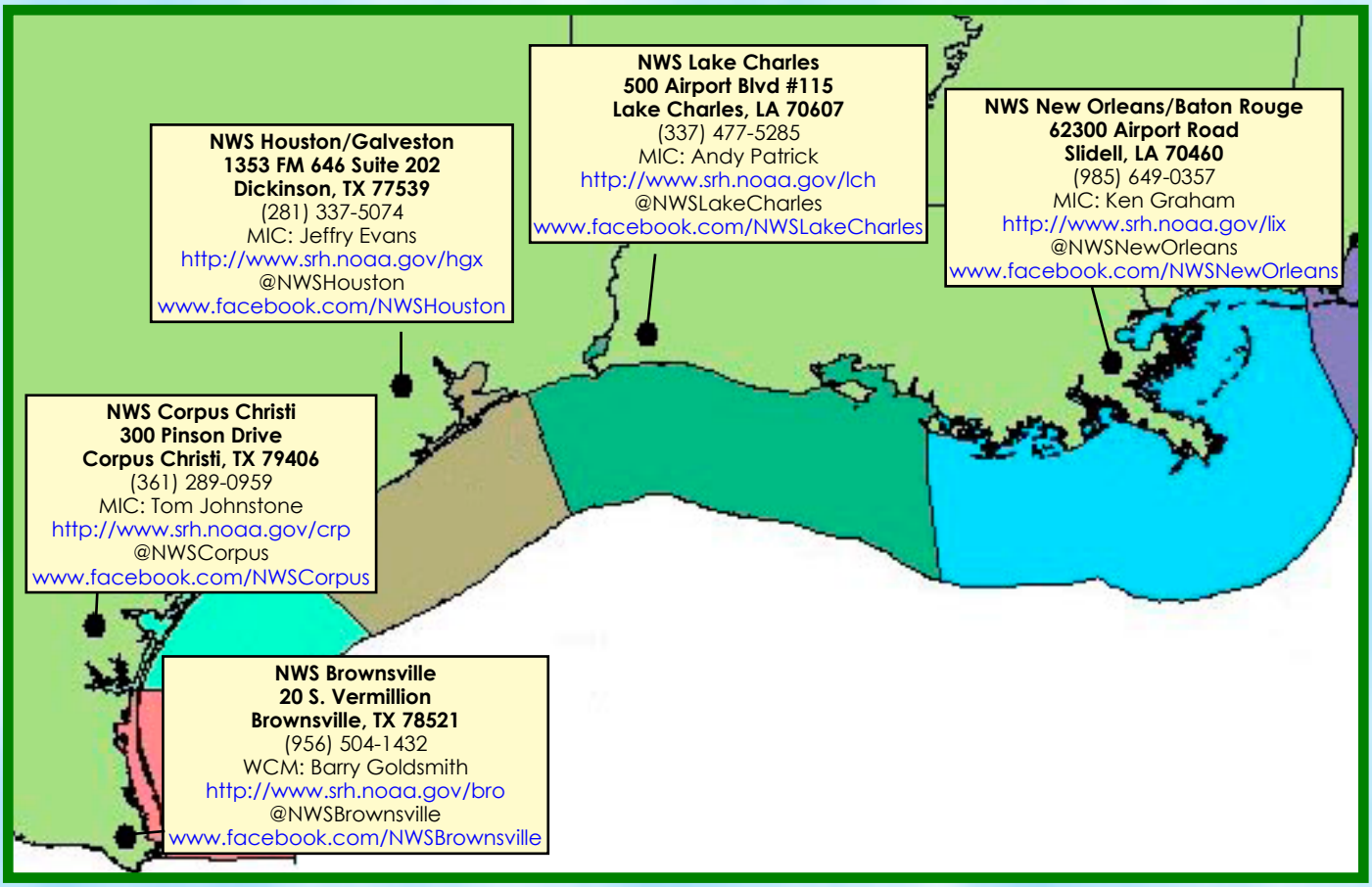
Weather Research Center

www.wxresearch.org

Community Resource Information:
Do Not Call 911 for Non-Emergencies!

2-1-1 TEXAS
Connecting People and Services

Regional National Weather Service Offices



2015 HURRICANE WORKSHOP

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